PHYSICAL REVIEW LETTERS
INFORMATION FOR CONTRIBUTORS
(Revised July 1998)

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Manuscripts may be **submitted** by a variety of electronic modes (including via e-print servers, direct Web upload, and email), or by conventional mail, but not by fax. Interactive **submission forms**, available on our Web server, are an integral part of the submission process for the e-print and Web modes, and are strongly recommended for email and conventional-mail submission. These forms aid authors in supplying all the information needed in a structured format which furthers efficient processing; they also provide a location for additional "free form" information. [For authors without Web browsers which support forms, noninteractive versions of the submission forms are available via ftp to aps.org in the /pub/jrnls directory as the sub_prl files (include filename suffix .asc, .tex, or .ps), or by request to the Editorial Office.]

Please specify the author to whom correspondence should be addressed, and give all available communications information for this individual (postal and email addresses, phone and fax numbers), since in various circumstances they may all be useful. Please specify journal and section to which the paper is submitted, and give PACS (Physics and Astronomy Classification Scheme) index categories for the work. (The scheme is available on our Web server, and also via ftp to aps.org in the /pub/pacs directory.)

A signed APS **copyright-transfer** form should be included with the submission, and will be required before publication. While the transfer of copyright takes effect only upon acceptance of the paper for publication in an APS journal, supplying the form initially can prevent unnecessary delays. The form appears at the end of the 9 March 1998 issue of *Physical Review Letters* and is available from the Editorial Office, on the World Wide Web via the URL http://publish.aps.org/ or via ftp to aps.org in the /pub/jrnls directory as the copy_trnsfr files (include filename suffix .asc, .ps, or .tex). Be sure to use the latest (1/96 or later) version of the form.

Papers should be written in scientific **English**, in a style consistent with that of the journal. The total length of a Letter should not exceed 4 journal pages; a Comment, 1 page. [Guidelines for estimating the length of manuscripts appear at the end of some issues of the journal, e.g., 7 July 1997, and via ftp to aps.org (length_est_prl.asc, etc., in the /pub/jrnls directory).] Submission is a representation that the work is not now being considered for publication elsewhere. Proper text reference must be made to portions previously published or scheduled for publication, including conference proceedings. See "Prior Disclosure," Phys. Rev. Lett. **52**, 2101 (1984).

Electronic submissions may be formatted in REVTeX (preferred), LaTeX, Harvmac, or Plain TeX. The file must be in ASCII containing no control codes, with line lengths of 80 characters or less. All textual material of the paper (including tables, captions, etc.) should be in electronic form, as a single file. The file should produce double-spaced output. Properly prepared electronic submissions are eligible for a **publication-charge discount**, whether or not they also qualify for the compuscript-conversion production program. See paragraph on "compuscripts" below.

REVTeX is APS's LaTeX macro package used to produce compuscript files with the standard structure and coding needed for our journals. The REVTeX software (macros, examples, and documentation) is available via ftp to aps.org in the /pub/revtex directory. For further information on REVTeX, inquire by electronic mail to mis@aps.org.

For information about submission via **e-print** servers or direct **Web upload**, see our Web server at http://publish.aps.org/ESUB/.

Electronic-mail submissions (and inquiries about them) should be sent to the Internet address prltex@aps.org. For the initial submission, use as the subject "submit" followed by "prl" and the last name of the first author; for example, "submit prl jones" or "submit PRL Jones". Include the filled-out submission form (or the equivalent information, including journal, postal address, etc.) in the first part of the electronic-mail message. Receipt of an electronic-mail submission will be acknowledged within 24 hours. Copies of the manuscript should not be sent by regular mail (only original figures) unless the electronic transmission has not been successful.

Figures for an electronic submission must be received in at least review-quality form before editorial processing can begin. Web upload or electronic-mail transmission (one figure per file) of PostScript-formatted figures will normally meet this need. For color or continuous-tone PostScript figures, hard-copy originals are also required. The originals are needed to ensure that the reproductions created from the electronic figure files are satisfactory. (For email transmission, use a subject line similar to that for the text file with the addition of the figure number, e.g., "submit prl jones fig1".) Alternatively, you could send scanner-reproducible journal-quality "originals" immediately by overnight mail. A third possibility is to send review-quality figures by fax (516-591-4141), while the "originals" are sent by conventional or overnight mail as soon as possible; please mark the fax transmission as being part of an electronic-mail submission. On resubmission, it is only necessary to resend your figures if the originals in our file are not longer valid.

Manuscripts sent by **conventional mail** should be submitted in *quadruplicate* to the Editors, Physical Review Letters, 1 Research Road, P.O. Box 9000, Ridge, NY 11961-9000. [The first copy, used for production purposes if the paper is accepted for publication, must be printed (double spaced) on one side of the paper only; additional copies, used for review purposes, may be printed on both sides of the paper.]

Manuscripts and figures are *not routinely returned* to authors. Authors should indicate (preferably on initial submittal) if they want the manuscript and/or figures returned when correspondence is sent during the editorial process, and/or after a final decision has been made.

For **resubmissions**, the interactive resubmission forms available on our Web server may be used for email, web-based-upload, and hard-copy transmission of modified manuscripts. These forms should also be used when a manuscript previously submitted to one APS journal is being submitted in modified form to another one (typically a former *Physical Review Letters* submission being submitted to *Physical Review*). Resubmissions from e-print archives are not yet supported. If you do not use the forms, please include a summary of

changes made and a brief response to all recommendations and criticisms; state whether or not the figures have been modified, and supply new PostScript or scanner-reproducible figures if there have been such changes; and update any other information (e.g., address and communication information) which has changed since initial submission.

If the manuscript was originally submitted electronically, please avoid resubmission by conventional means (paper, postal mail); continue to use one of the electronic modes. When **resubmitting electronically**, please send the complete file for the text if there have been any changes. Send email resubmissions to prltex@aps.org, and use as the subject of the message "resub" followed by the manuscript code number and the last name of the first author; for example, "resub LM1234 Smith" or "resub lm1234 smith." Include the filled-out resubmission form (or equivalent information as described above) as the first part of the message. For **resubmission by conventional mail**, please send four copies of a complete modified manuscript, and include the form or equivalent information.

Fax transmission of a message to the editor, summary of changes made to the paper, or response to reviewer comments is sometimes usable by the editorial office. Nevertheless, because of the unreliable quality of faxed copy and our limited facilities for handling such correspondence we prefer that conventional, overnight, or electronic mail be used instead.

Material for publication (manuscripts, replacement pages, figures) that is sent by fax is generally unusable for review or production purposes. If you have minimal changes to your paper, we might be able to accommodate them by copying them to the good copy in the editorial office. If the changes are involved or numerous, this will not be possible. You can send pages for substitution but be sure to mark the changes so we can judge what is required if we are to consider transcribing them. In any case, send good copy by conventional or overnight mail as soon as possible. We may not be able to proceed until it arrives.

Authors are notified by electronic mail or fax of the editorial acceptance of their article. When a revised manuscript or electronic file is received after that, corrections are made by our production vendor to their SGML file already in existence. If the revisions are not separately and explicitly described, the author may be requested by the editorial office to provide such a description. When technical or styling questions arise during the production process, we attempt to contact the author by phone, electronic mail, or fax. Proofs are normally sent (via fax) to authors.

The following are general guidelines for preparation of a conventional manuscript or a compuscript. In addition, memos regarding production requirements appear at the end of some issues of the journal. For more detailed style information, consult the *Physical Review Style and Notation Guide*, available via ftp to aps.org in the /pub/jrnls directory as the style_guide files (including filename suffix, .pdf, .ps, or .tex). Additional style guidelines may be found in the *AIP Style Manual*, 4th ed., 1990 (ISBN 0-88318-642-X, $10.00 prepaid) available from Springer-Verlag, P.O. Box 2485, Secaucus, NJ 07096-2485. Also consult recent issues of the journal.

A **manuscript**, comprising all material which is to be set in type, must be typewritten (except possibly for mathematical expressions and Greek letters; see below), double spaced (3 lines per inch, at least 6 mm of white space between lines) in type size such that there are ≤ 90 characters/6 in., on one side only of good quality, white, approximately 8.5×11-in. (or A4) paper, with margins of at least 1 in. along four edges. A clear, sharp, nonerasable, black-on-white reproduction on hard-surfaced paper is acceptable as the "original." Number all pages (including the title page). Include copies of any figures at the end of the manuscript.

Mathematical expressions should be typed, or neatly written in ink. The prime requisite is that the copy shall be clear to the production keyboarder, who is neither a physicist nor a mathematician. Unusual or ambiguous symbols (see table on page 21 of the *Style Manual*) should be identified by marginal notes at first appearance and subsequently when confusion might arise; for nonalphabetic symbols, give the number found on pages 44 and 45 of the *Style Manual.* Mark superscripts with an inverted caret below, and subscripts with a caret above, if necessary. Three-vectors and dyadics are set in boldface type (mark with a black-pencil, wiggly underline).

Editorial marking by authors, except for the resolution of ambiguities as discussed above, is rarely of sufficient value to warrant the effort.

A **compuscript** (i.e., an electronic submission that can be used in production) should be formatted in REVTeX. It must be free of any custom low-level formatting macros or private style files; "keystroke-saving" macros may be used. The file must be in ASCII containing no control codes, with line lengths of 80 characters or less; it should produce double-spaced output. Further details regarding preparation of a compuscript appear in the booklet "PRL REVTeX Electronic-Submission Compuscript Program" [available via ftp to aps.org (compu_inform_prl.asc, etc., in the /pub/jrnls directory)]. If the paper is accepted for publication, the file is converted to SGML format and coding, from which base the journal pages are composed. Appropriate REVTeX files are eligible (the other electronic-submission formats are only useful for the editorial-review process). Questions about file eligibility should be directed to prltex@aps.org. Papers intended for the compuscript production program should be submitted and resubmitted *only electronically*. PostScript figures may be used directly (electronically) in the production composition process.

The author must carefully **proofread** the paper to eliminate grammatical errors, misspellings, and omission of symbols. The text should be directed at a **general readership,** not specialists. Avoid acronyms and jargon, even if they seem of common usage. If unavoidable, define them in the text. **Notation** should be unambiguous, concise, and consistent with standard usage. Introduce new terminology or notation only when clearly needed. Indent all paragraphs. Use the solidus (slash) only to denote division of mathematical quantities, to denote (optionally) an interface between materials [e.g., Ag/Cu(001)], and in "and/or." Its meaning when used between words is usually imprecise; use the proper conjunction or punctuation.

The **length** of the paper is crucial. Avoid excess white space in figures; unneeded numbering of displayed equations may add length; references which are incomplete may lead to an underestimate of the length; and note that right-adjusted text or text with very nonuniform line length is subject to greater error in its estimated length. Also note that equations in text (undisplayed) must be simple; some equations which are presented in text may require display for printing and thus add to the length.

Ideally, figures are planned for reduction to final journal size on the basis of their content and detail. The size of lettering should be chosen with this in mind. If the lettering is drafted too small, full reduction will not be possible; the length will have been underestimated. At final reduction, the size of the smallest capital letters and numerals is to be at least 2 mm.

Ultimately it is the responsibility of the author to provide a paper of the proper length. The Editorial Office attempts to provide some guidance. A quick-count formula is applied to each new paper. The staff makes a more careful estimate of the publication length of those whose quick count exceeds a limit value, and reports the calculation to the author. In a case of excessive length, the paper must be shortened prior to review. In a case of the estimated length being close to the final limit, the author is advised to make the next version shorter. The length restriction applies to all versions of a paper. Upon acceptance of a paper for publication, length is again considered by the staff; the author may be requested to supply the shortened version before production can proceed. The composition of the paper into journal pages is the final criterion. If the length is still excessive, page copies are faxed to the author; publication is delayed until satisfactory cuts are obtained.

An advantage of preparing a compuscript using REVTeX is that it facilitates an easy but accurate assessment by the author of the paper's length. The macro package supplied to authors permits generation of galley-format (single narrow column) output; use the prl style option. From this, a direct count or a measurement of journal text lines can be made. Include the separation of abstract, captions, and reference list from text (e.g., +2 lines of "white space" for each separation). Note that long equations and wide sections of text incur a double count, and this must be properly taken into account. The space that will be occupied by figures should then be added. Figures can be planned for reproduction according to their content and lettering size as described below. On the journal page, the two-column area available for text and figures is nominally 9.5 in. (24 cm) deep; 6 text lines occupy 1 in. of vertical space.

The **title** should be concise, but informative enough to instruct the nonexpert reader and to facilitate information retrieval. Do not introduce new terminology in titles. There must be an **abstract** (double spaced) of no more than 600 characters, including spaces, which should be self-contained (no footnotes) for reprinting in abstracting journals. Comments and Replies should not include an abstract.

The **names of authors** may be listed in any order in the byline between the title and abstract. If the number of authors exceeds 40, the authors will be listed in the Table of Contents as, e.g., A. Jones *et al.* The author who submits the paper should ensure that all persons listed as authors approve the inclusion of their names, and check that the form of each name is the one normally used by that author.

Byline addresses are set directly under the author names. They are intended to indicate the institution where the research was done. These addresses usually consist of department or division, institution, city, state or country. Street addresses, post office boxes, etc., may be included; zip and postal codes are proper.

A limited number of byline formats are allowed: Authors may be grouped together by institution(s), with the name and location of their institution(s) following each group. It is permissible to have two groups from a single institution (different departments). A more concise presentation is a single list of authors followed by the list of institutions. A variant of this form, to show specific affiliations, is to use a key to link each author to his or her institution(s) unambiguously. The key consists of a superscript numeral, and is placed, in order, at the beginning of each institution listing; each author's name then carries the appropriate key(s). It is also permitted to give a group (collaboration) name in addition to the single full list of authors' names. The group name is put in parentheses, between the end of the list of authors and the beginning of the list of institutions. If the number of authors exceeds 40 the group name will appear in the Table of Contents.

Footnotes to an author's name or address should be limited to those useful for location of, or communication with, an author. Use the symbols (always as superscripts) *, †, ‡, §, ‖, ¶, **, ††, ‡‡, §§, ‖‖, ¶¶ (in the order listed) if there are 12 or fewer footnotes. Use lower-case alphabetical a, b, c, etc., if there are 13 or more footnotes. Footnotes giving electronic addresses (e.g., email, fax, or Web) of a corresponding author are encouraged. Footnotes which describe an author's position or title are not acceptable. Information concerning financial support (funding agencies, programs) or affiliations of institutions themselves with larger organizations should be listed in an acknowledgments paragraph.

Punctuate **mathematical expressions** and displayed equations as part of the sentence. In general, use *single-letter* symbols for mathematical quantities in equations and expressions, possibly with subscript or superscript indices or labels and with argument(s) in parentheses. There are a few well established multiletter exceptions, such as the trigonometric functions. Avoid complicated superscripts and subscripts. Avoid frequent repetition of a complicated mathematical expression; represent it by some convenient symbol. Use the form $\exp(\cdot)$ in cases of long or complicated arguments. Except for the square root of a simple quantity without superscripts, use fractional exponents instead of the radical sign. Avoid the use of bars over extended expressions. Avoid the use of diacritical marks (tildes, etc.) over groups of symbols, as well as the use of double oversymbols (e.g., a caret over a tilde). Use the solidus (/) or negative exponents for fractions in running text, and in displayed equations when this does not reduce clarity. When the extent of a denominator is ambiguous, use appropriate bracketing to ensure clarity. Give the base of logarithms (e.g., ln, $\log_{10}$, $\log_2$). "Dangling" decimal points should be preceded or followed by zeros or deleted, as appropriate. **Displayed equations** should be punctuated and aligned to bring out their structure. Put equation numbers in parentheses at the *right-hand* margin.

Three-vectors and dyadics are commonly set in boldface type. Four-vectors are set in italic type for Latin letters, and in ordinary type for Greek letters. Vectors in more than four dimensions may be set in either boldface or lightface (italic for Latin letters) type. More general quantities, such as matrices, operators, etc., should generally not be distinguished from scalars typographically unless essential to avoid confusion; in that case, either boldface or some sort of "decoration," such as a caret, is satisfactory. Do not use the center dot to indicate multiplication of scalars.

A final **acknowledgments** paragraph may be used to recognize named individuals who contributed scientifically to the specific research of the paper, to cite the funding agencies that provided financial support for the work, and to note the affiliation of institutions in the byline with a larger system. The statement of thanks for help should be simple and may not be a dedication or memorial. References to memberships, positions, titles, and awards are inappropriate, as are dates associated with funding. It is unnecessary to give the exact form, e.g., fellowship, scholarship, program name, in which funding was granted.

Footnotes, both references *and remarks*, must be numbered consecutively in order of citation, and be given in a double-spaced list at the end of the main text. The journal does not use the bottom-of-page footnotes. Footnotes to the byline (superscript *, †, ‡, etc., or a, b, c, etc.) will lead the list. (Order a reference cited in a figure or table caption as if cited when the figure or table is *first* mentioned in the text.) Cite footnotes in text, captions, or other footnotes in the form "Smith, Doe, and Jones [2]," "recent experiments [1,4–6]," or "(see Ref. [8])." Almost all references should cite each author in the form "F. Jones." Consider the form "F. Jones *et al.*" (no comma before *et*) only when there are four or more authors. The reference should cite: journal name, volume number, page, and year (in the case of translation journals, give information for original *and* translation); conference name (or topic), place, year, editor(s), publisher, and year of publication; book title, editor(s), publisher, and year of publication; report issuing institution in full and identification number of the report (give title if number not available). Some examples of proper form follow (also consult recent issues of the journal).

J. M. Smith, R. Brown, and C. Green, Phys. Rev. B **26**, 1 (1982); Nucl. Phys. **A195**, 1 (1982).

J. M. Smith, Phys. Rev. D (to be published); R. Brown, Phys. Rev. B **26**, 706(E) (1982).

J. M. Smith, *Molecular Dynamics* (Academic, New York, 1980), Vol. 20, p. 20.

R. Brown, in *Charge Density Waves in Solids*, edited by C. Green, Modern Problems in Condensed Matter Sciences Vol. 25 (North-Holland, Amsterdam, 1989).

C. Green, University of Wisconsin, Madison, Report No. MAD/PH/650, 1991.

J. M. Smith *et al.*, in Proceedings of the Topical Meeting on *CP* Violation, Calcutta, June 1990 (unpublished).

It is important to confirm the accuracy of bibliographic information in references. This has become more important now that the journal is online. Hyperlinks will be programmed to enable readers to "click" on references and jump directly to the material cited. If your reference citations are incorrect or incomplete (e.g., missing author name, or an incorrect volume number or page), the associated hyperlinks may fail, and the usefulness of your paper in the online environment may be diminished. Since at the present time such links work only from the reference section, work cited anywhere in the paper, including in figure and table captions and in "Note(s) added," should be included in the reference section.

Separate **tables**, numbered in the order in which they are referred to in text, should be used for all but the simplest tabular material. Include them after the reference and footnotes. Each table *must* have a caption (double spaced) that makes the table intelligible without reference to the text. Column headings should be simple and contain all units; symbols should be explained in the caption. Use a single horizontal rule to separate headings and entries. Use horizontally running space to distinguish broad groups among entries, and extra vertically running space for columnar groups. Vertical rules should not be used. Denote footnotes in a table by superscript lower-case roman letters, and list at the end of the table.

Plan **figures** for the 3.375-in. column width of the journal; when the detail is great 1.5 to 2 columns may be used. Wasted space at the top and bottom should be avoided. Carefully prepared figures, suitable for digital scanning, are required (original India-ink drawings or glossy prints; computer-generated figures, if of sufficient quality, are acceptable). Figures must have a clear background and unbroken lines with as much black-white contrast as possible. *Final-journal-size* originals or prints are preferable to oversized originals. Avoid small open symbols which tend to fill in upon reproduction, small dots and decimal points, and shading or cross-hatching that is not coarse enough to withstand reproduction. The lettering and plotted points on the figures should be large and clear enough that they will be legible on the journal pages (final journal size of lettering should be at least 2 mm). Inconsistently large or too heavy lettering should be avoided. Line weights should be consistent throughout a figure, with a final line weight of at least 0.18 mm (0.5 point). Figures reproduced directly from an automatic plotter or computer printer must have lettering of the correct size and style (e.g., MeV instead of MEV, unslashed zeros) and curves that are smooth and of sufficient line weight to allow suitable reproduction. The resolution of the drawing software and the output device should be set as high as possible (preferably 600 dpi or higher). Very fine lines in laser-generated illustrations will disappear under scanning. Photographs of apparatus are unacceptable and should be replaced by good schematic diagrams.

Photographic (continuous tone) material is **screened** ("halftoned") within our production process. Avoid submitting prescreened prints of photographic material; reproduction of such figures is seldom satisfactory. There is a risk of moiré patterns appearing in the final product. Laser-printer renditions of continuous-tone data are similarly problematic, since they are effectively prescreened. Please submit such figures electronically as PostScript files (one image per file). There are greater possibilities for successful reproduction in the journal when these data are processed directly rather than via scanning of hard-copy renditions. Alternatively, supply glossy or matte-finish photographs instead, if available. Otherwise, choose the highest resolution possible and laser print the figure at its final published size.

Figures should be numbered in the order in which they are cited in the text. The original figures, as well as the copies supplied for review purposes, should be identified on the *front* (well outside the image area) by the number, the name of the first author, and the journal. An indication, e.g., "TOP," of the intended orientation of a figure is helpful, especially in ambiguous cases. Be advised that the scanner reproduces all flaws (e.g., correction fluid, tape, smudges, writing on the back of the figure). Each figure must have its own caption; list captions on a separate sheet. Groups of figures that share a common (single) caption must be labeled "(a), (b), (c)," etc. It is preferable that all parts of a figure be submitted as a single piece. The figure should have properly labeled axes with correctly abbreviated units. Use the form R (10^3 Ω), not $R \times 10^3$ ohms. For complete instructions see the *Physical Review Style and Notation Guide* and the *AIP Style Manual*.

Some figures might be more effective in **color**. This option is available; price schedules can be obtained from the Editorial Office at Ridge. The cost of publishing illustrations in color must be borne in full by the respective authors and their institutions. Authors who wish to avail themselves of this option should provide 35-mm slides or transparencies, or high-quality glossy prints, which should be close to the final size expected for publication. (Negatives are not acceptable.) Polaroid color prints should be avoided. Artwork must be flexible. If submitting slides, please note that they will be removed from their jackets for the color separator. In some cases, printing requirements will prevent figures from being

located in the most preferred position. To alert readers of monochrome reproductions of the article that the archive figure is in color, begin the caption "Fig. 1(color)." Be advised that production of an editorially accepted paper that contains color can begin only after a properly completed color-illustration authorization form has been received from the author.

To aid the reviewers, provide color copies with each submitted manuscript copy. If a figure is *not* intended for printing in color, then only a black and white version and copies should be submitted.

In order to **reproduce** figures, tables, etc., from another journal, authors must show that they have complied with the requirements of the publisher of the other journal, possibly including written agreement of both publisher and author of the originally published work. (If the original journal is published by APS, only the written agreement of the original author is required to reproduce a few figures or tables.)